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THE DEVELOPMENT AND EVALUATION OF AN AUTOMATED INSTRUCTIONAL PROGRAM IN SPEECH CORRECTION. FINAL REPORT.

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TO COMPARE CONVENTIONAL AND PROGRAMED INSTRUCTION ON TEACHING AUDITORY DISCRIMINATION OF THE "S" PHONEME, 20 LESSONS CONTAINING STIMULUS AND REPEAT ITEMS WERE RECORDED ON A COMMERCIAL MULTI- CHANNEL DEVICE THAT ALLOWS CONTINUOUS ADJUSTMENT ON THE BASIS OF RESPONSE. THE 40 GRADES TWO-FOUR PARTICIPANTS, MATCHED ON AGE, SEX, AND IQ, WERE GIVEN THREE ARTICULATION AND DISCRIMINATION ACHIEVEMENT TESTS BEFORE, IMMEDIATELY AFTER, AND ONE MONTH AFTER INSTRUCTION. EXPERIMENTAL SUBJECTS WORKED SOLELY ON THE EQUIPMENT, WHEREAS CONTROL SUBJECTS RESPONDED VERBALLY TO DISCRIMINATION TASKS AND WERE NOT GIVEN POSITIVE REINFORCEMENT FOR CORRECT RESPONSES. BOTH GROUPS SHOWED EQUALLY SIGNIFICANT LEARNING IN, AND RETENTION OF, PHONEME AND GENERAL DISCRIMINATION, AND PHONEME AND GENERAL ARTICULATION, ALTHOUGH NO SPECIFIC INSTRUCTION WAS GIVEN FOR THE LAST THREE SKILLS. TIME TO COMPLETION WAS LONGER FOR THE EXPERIMENTAL GROUP. IN VIEW OF THE CRITICAL SHORTAGE OF QUALIFIED SPEECH PATHOLOGISTS IN THE PUBLIC SCHOOLS, IT WAS CONCLUDED THAT ADDITION OF AUTOMATED INSTRUCTION IN SPEECH PATHOLOGY IS DESIRABLE AND PRACTICAL. (LH)

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Helen G. Burr

and

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Charlottesville, Virginia

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I. INTRODUCTION

There is a high incidence of defective speech in children of school age and a continuing shortage of speech clinicians in the schools of the nation. The demand to provide more assistance to speech defective children in the public schools is persistent, and ways to supplement and extend the work of public school speech clinicians are urgently needed.

Approximately seventy-five per cent of all speech problems encountered by the public school speech clinician involve articulation. In the correction of articulatory errors, the importance of auditory discrimination training is widely recognized. Speech pathologists are in general agreement that the first step in articulation therapy is the development of the ability to discriminate speech sounds. "When articulatory cases are seen daily, it is customary to spend at least a week or two in ear training before the student ever attempts to produce the correct sound." (31) In addition, reading authorities are aware of the importance of auditory discrimination. Ruth Strang (25) emphasizes that auditory discrimination is one of the readinesses for reading.

Although the teaching of auditory discrimination appears to be amenable to automated instructional programming, the relative efficiency of automated techniques and traditional methods for the improvement of speech sound discrimination in children has not been demonstrated through research, and automated techniques are not currently used for this purpose. If automated instruction in auditory discrimination could be demonstrated to be equally effective or superior to traditional methods, the implementation of it in the public schools would have a number of advantages.

1. The shortage of qualified personnel in speech pathology and reading would have less impact, because services could be increased without a parallel increase in staff.

2. Uneven abilities of personnel in speech pathology and reading in providing auditory discrimination instruction would be overcome by the availability of self-instructional programs.

3. Teacher ability, time, and energy could be invested in those aspects of remedial instruction which are less amenable to self-instructional devices than the teaching of auditory discrimination.

4. The child could progress at his own pace in acquiring auditory discrimination ability.

Thus, automated instruction in auditory discrimination could provide solutions to some of the critical problems of administering speech and reading programs in the public schools.

A. Auditory Discrimination in Speech Pathology

Auditory discrimination as an etiological factor in functional articulatory defects, has been the subject of considerable investigation in the last thirty-five years. Among the earliest researchers were Travis and Rasmus (29) who developed and used a test for speech sound discrimination in comparing good speakers with functional articulatory cases. On the basis of their results, they considered a deficiency in speech sound discrimination ability to be important etiologically.

During the next several years the Travis-Rasmus test was used in four investigations, each of which demonstrated little or no relationship between discrimination deficiency and functional disorders or articulation. (3, 6, 10, 11) Using a specially designed test of speech sound discrimination, Mase (15) , in a further investigation, also found no significant relationship. In a more recent study, Aungst and Frick (2) reached similar conclusions.

Beginning in 1950 with the Donewald study (8) , a series of researchers independently confirmed the original Travis-Rasmus conclusion. (1, 14, 20, 24, 26, 27) The results of the most recent of these studies, by Cohen and Diehl (7) , contradict the majority of the early investigations and validate the research of Travis and Rasmus and most of the more recent investigations that children with functional disorders of articulation make significantly more discrimination errors that do children with normal speech. They conclude that "testing of discrimination ability seems logical in all speech defective cases with articulation errors." They further hypothesize that "major emphasis should be placed on improving sound discrimination ability in children with articulation problems who demonstrate poor auditory discrimination." In a critical review of the published literature on auditory discrimination and articulation, reported in the February, 1967 issue of the Journal of Speech and Hearing Disorders, Paul S. Weiner (32)

states "that the evidence does support the hypothesis of a link between auditory discrimination and articulation defects...in the primary age group."

B. Auditory Discrimination in Reading

The importance of auditory discrimination ability is generally recognized by reading authorities. In 1950 Emmett Betts (4) stated that "the ability to discriminate between speech sounds is a basic factor in language readiness for reading." Ruth Strang (25) indicates that auditory discrimination is one of the readinesses for reading which teachers either test or systematically observe. In a review of research on reading, Nila Banton Smith (23) , in 1955, concluded that "it would be well to give more attention to...auditory discrimination in teaching all types of word recognition." More recently Smith (22) says that "it does a child no good simply to <u>see</u> likenesses and differences in word elements unless he also knows the sounds of these elements," that "he must learn the skill of <u>auditory discrimination</u>," and that this ability is an "important component of the total phonic process." In an investigation in 1960 Murray (18) found a "very significant relationship between auditory discrimination and reading achievement." In a study involving control and experimental groups at the first-grade level, Leota E. Smith (21) found significant relationships among instruction with emphasis on auditory discrimination, reading readiness, intelligence, and reading achievement. Goetzinger, Dirks, and Baer (9) investigated auditory discrimination and visual perception in good and poor readers and concluded that "a true difference in auditory discrimination and auditory perception abilities may exist for good and poor readers even when vision and hearing are normal." After reviewing 198 references, Morrone (17) stated that "most of the scientifically accurate experiments show that phonics have considerable value to the learner in the reading process."

C. Automated Instruction in Speech Pathology

Prior to mid-century, only occasional references were made to programmed instruction. However, in recent years a vast literature has mushroomed. Numerous articles have appeared on a wide variety of programming in many different disciplines. One discipline that has largely neglected programmed learning is the

discipline of speech pathology. Audio machine programming, the logical form for programmed instruction in the correction of speech and language disorders, has been delayed because of the complication of constructing audio devices with the electro mechanics of a teaching machine.

There is a paucity of professional literature on automated instruction in speech pathology. Of particular pertinence to the present investigation is the Holland and Matthews (12) comparison study of three experimental teaching machine programs for instruction in speech sound discrimination to children with defective articulation of the consonant /s/. These programs were especially constructed for the study. Program I included discrimination of the /s/ in isolation, in words, in position within words, and of words correctly and incorrectly articulated. Program II involved only discrimination of isolated speech sounds. Program III was limited to discrimination of correctly and incorrectly articulated words. Equipment used in the investigation was a Wollensak *Model T-1600 tape* recorder, modified for the study. The recorder functioned as an "automated teaching machine" only when the experimenter was present to perform certain manipulative functions. The machine cannot truly be called automated, because the presence of the experimenter was necessary for the machine to function. On the basis of their investigation, Holland and Matthews decided that Program I was "clearly the superior," that "techniques for improvement of /s/ discrimination in children who misarticulate /s/ are amenable to teaching machine programming," and that "teaching machines can contribute to the field of speech pathology and audiology." A subsequent evaluation by Bloom (5) of a number of subjects who had participated in the Holland-Matthews study, also indicated the usefulness of teaching machines for instruction in auditory discrimination. Finally, in a recent report of a follow-up two-year demonstration project, Holland (13) concluded "that programmed speech sound discrimination training is a feasible and useful technique for modifying both auditory discrimination and articulatory patterns in children who misarticulate."

However, none of this research has clearly revealed how well students learn from programmed instruction as compared with how well they learn from other kinds of instruction.

D. Objectives

The purpose of the present investigation was to compare the effectiveness of automated and traditional procedures for teaching auditory discrimination of the /s/ phoneme. To accomplish this, a sequence of lessons was developed for automated self-instruction and matched groups of subjects were established.

The following hypotheses were tested:

1. There is no significant difference between the experimental group and the control group on achievement in auditory discrimination of the /s/ phoneme.

2. There is no significant difference between the experimental group and the control group on rate of achievement in auditory discrimination of the /s/ phoneme.

3. There are no significant differences between the experimental group and the control group on achievement in general auditory discrimination, articulation of the /s/ phoneme, or articulation of phonemes other than /s/.

4. There are no significant differences between pre and post program performance on auditory discrimination of the /s/ phoneme, general auditory discrimination, articulation of the /s/ phoneme, and articulation of phonemes other than /s/ for the experimental group or the control group.

5. There are no significant differences in retention of achievement on auditory discrimination of the /s/ phoneme, general auditory discrimination, articulation of the /s/ phoneme, and articulation of phonemes other than /s/ for the experimental group or the control group.

II. METHODS

An automated program consisting of twenty lessons for self-instruction in auditory discrimination of the /s/ phoneme was developed.

A. Equipment

The equipment used in this study was the Audio Notebook developed by Electronic Futures, Incorporated. The Audio Notebook provides for dial selection of twenty-two fifteen-minute channels, is not limited to simple predetermined sequences, and allows for continuous adjustment on the basis of response. It employs multi-channel magnetic tape on a one-inch reel and has a moveable reproducing head controlled by a channel selector. At any given instant of time the child could, therefore, select any one of the channels and could move vertically as well as horizontally through a lesson. The maximum manipulation required of the child was switching from one channel to another by audio direction.

B. Program Design

The program, consisting of twenty lessons, was recorded on twenty EFI multi-channel magnetic tapes. Only thirteen of the twenty-two channels of each tape were employed. Each lesson provided 156 half-minute items, of which 78 were stimulus items and 78 were repeat items. Stimulus and repeat items were randomized within columns. Each lesson began with a half minute of general instructions on channel 1. The child was told to listen to a given stimulus, make a decision in terms of that stimulus, and switch to another channel on the basis of his decision. If he made a correct decision, he received praise, instruction, and stimulation for the next item. If he made an incorrect decision, he was informed that he had made an error, he heard the item repeated, and was told to switch to the next stimulus item. Items which indicated a correct response were preceded by a musical tone; items which indicated an error were preceded by a raucous noise.

The child who made an errorless progression was exposed to twelve stimulus items, and could complete the lesson in six and one-half minutes. The child who made all possible errors was

exposed to twelve stimulus items and twelve repeat items, and could complete the lesson in twelve and one-half minutes. Tables I, II, and III present a design of a sample lesson and indicate progressions a child might make in completing the lesson with no errors, with all possible errors, and with a moderate number of errors.

A number of methods were used for varying discrimination difficulty. The twenty lessons were organized in four major sections based on the therapy sequence outlined by Powers (19) to provide ascending levels of task difficulty from section to section. The four sections were:

1. Discrimination of /s/ in isolation from other isolated phonemes

2. Discrimination of /s/ in words

3. Identification of the position of /s/ within a word

4. Discrimination of correctly articulated from misarticulated /s/ in words

Thus levels of ascending difficulty were inherent in the overall organizational plan.

Additional methods were combined with the method of organization and with one another to construct steps of gradually increasing discrimination difficulty within lessons and among lessons within sections. No one section or lesson employed all methods. Variations were established in six ways:

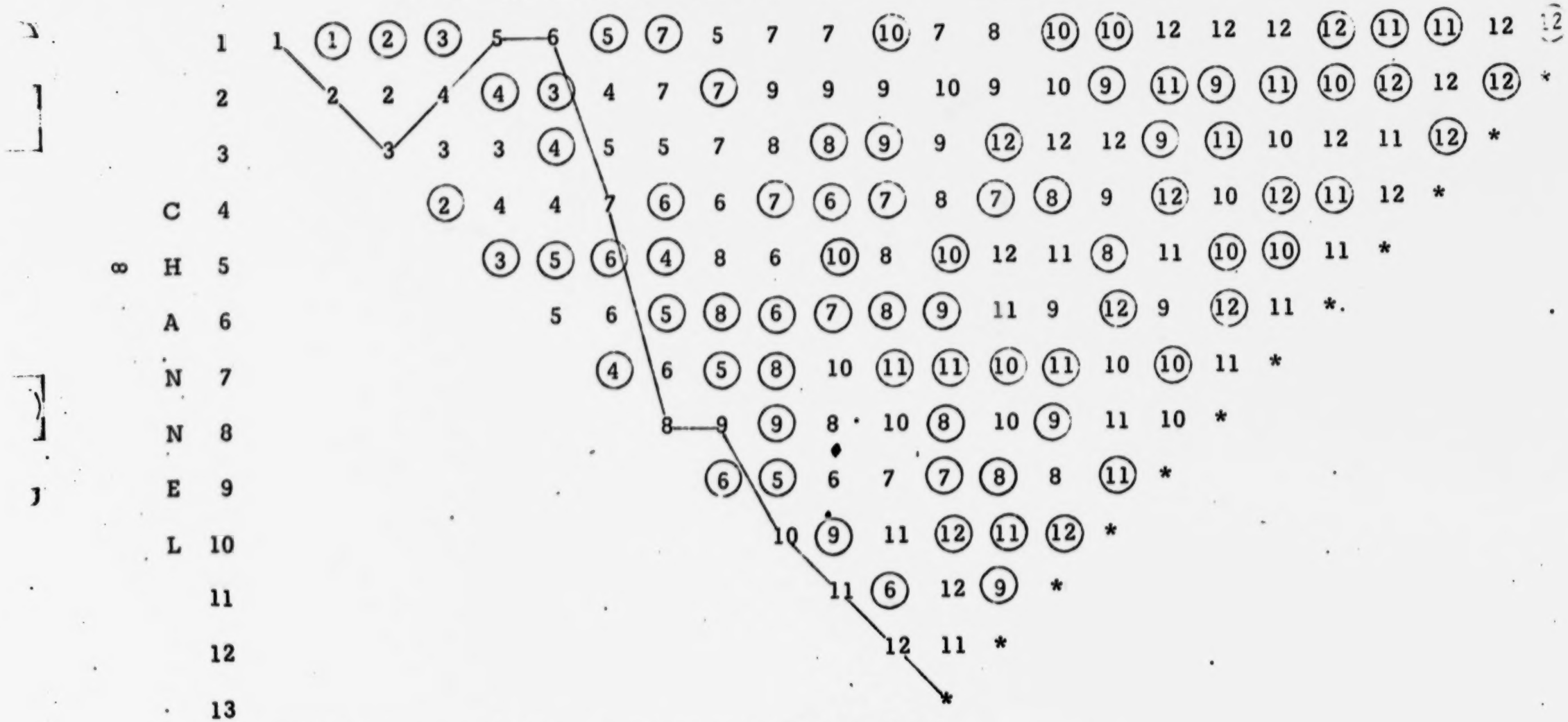
1. Loudness: Presentation employed three arbitrary levels of loudness. Progression was from loud to moderate to soft.

2. Duration: Presentation employed three arbitrary levels of duration paralleling levels of loudness. Progression was from long to medium to short.

3. Position of /s/ in Words: Progression was from initial to final to medial.

TABLE I

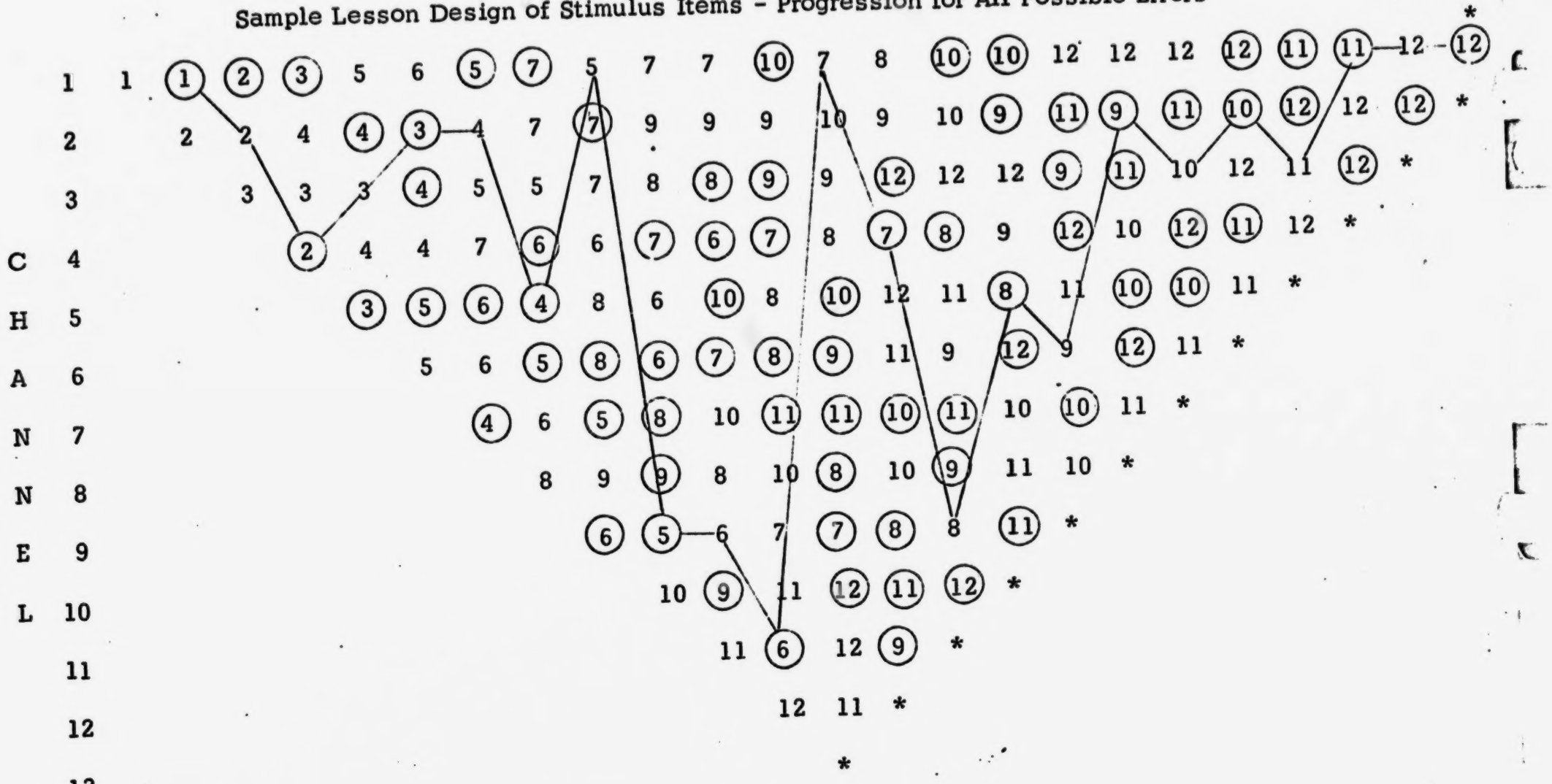
Sample Lesson Design of Stimulus Items - Errorless Progression



Repeat items are circled. * = Stop and raise your hand.

TABLE II

Sample Lesson Design of Stimulus Items - Progression for All Possible Errors



Repeat items are circled. * = Stop and raise your hand.

TABLE III

Sample Lesson Design of Stimulus Items - Typical Progression for Moderate Number of Errors

	1	1	(1)	(2)	(3)	5	6	(5)	(7)	5	7	7	(10)	7	8	(10)	(10)	12	12	12	(12)	(11)	(11)	12	(12)	*
	2		2	2	4	(4)	(3)	4	7	(7)	9	9	9	10	9	10	(9)	(11)	(9)	(11)	(10)	(12)	12	(12)	*	
	3			3	3	3	(4)	5	5	7	8	(8)	(9)	9	(12)	12	12	(9)	(11)	10	12	11	(12)	*		
C	4				(2)	4	4	7	(6)	6	(7)	6	(7)	8	7	(8)	9	(12)	10	(12)	(11)	12	*			
H	5					(3)	(5)	(6)	4	8	6	(10)	8	(10)	12	11	(8)	11	(10)	(10)	11	*				
A	6						5	6	(5)	(8)	(6)	7	(8)	9	11	9	(12)	9	(12)	11	*					
N	7							(4)	6	(5)	(8)	10	(11)	(11)	(10)	(11)	10	(10)	11	*					
N	8								8	9	(9)	8	10	(8)	10	(9)	11	10	*						
E	9									(6)	(5)	6	7	(7)	(8)	8	(11)	*							
L	10										10	(9)	11	(12)	(11)	(12)	*								
	11											11	(6)	12	(9)	*									
	12												12	11	*										
	13													*											

Repeat items are circled. * = Stop and raise your hand.

4. Errors of Production of /s/: Progression was from omission to substitution to distortion with distortions ordered in ascending levels of discrimination difficulty in terms of closeness of contrasting phoneme.

5. Discrimination of /s/ in Isolation: Progression was through four types of tasks:

a. Indication of whether two phonemes were the same or different

b. Indication of whether /s/ was present within a group of three or more phonemes

c. Indication of the position of /s/ within a group of three phonemes

d. Counting the number of times /s/ occurred in a group of four or more phonemes

6. Selection and Arrangement of Test Items on the Basis of Organo-Genetic Distinctive Features: The basis for progression was determined by establishing a distribution of organo-genetic distinctive features of phonemes differing from /s/ in manner, voicing, and place of articulation. (See Table IV.) Determination of progression within each of the three groups of contrasting phonemes was made by giving precedence to manner over voicing and voicing over place of articulation, and by further ranking of phonemes in terms of their closeness to the place of modal /s/ articulation. (16) (See Table V.) Because the complexity of the discrimination act increases in proportion to the reduction in contrast, progression was from items differing from /s/ by three distinctive features to items differing by two distinctive features to items differing by one distinctive feature.

In Section I of the program attention was focused on discrimination of /s/ in isolation, and involved the four types of tasks described above. Varying levels of discrimination difficulty were established through loudness, organo-genetic distinctive features, and the specific tasks. Examination of the diagrams in Table VI will reveal the characteristics of each item in the first five lessons. For example, Item 8 of Lesson 3 was presented at a

TABLE IV

Distribution of Organo-Genetic Disctinctive Features of Phonemes Differing From /s/, Based on Manner, Voicing, and Placement

PHONEMES	Manner					Voicing		Placement							NUMBER OF CONTRASTS
	Glide	Semi-Vowel	Nasal	Stop	Fricative	Voiceless	Voiced	Labial	Labio-Dental	Dental	Alveolar	Palatal	Velar		
s					+	+					+				0
t				+		+					+				1
f					+	+			+						1
θ					+	+				+					1
n					+		+				+				1
ʃ					+	+						+			1
tʃ					+	+						+			1
d				+			+				+				2
p				+		+		+							2
k				+		+							+		2
v					+		+		+						2
ð					+		+			+					2
z					+		+					+			2
ʒ					+		+					+			2
dʒ			+				+				+				2
r		+					+				+				2
b				+			+	+							3
g				+			+						+		3
m			+				+	+							3
w			+				+						+		3
ɹ		+					+					+			3
j	+						+	+							3
	+						+					+			3

TABLE V

Distribution of Organo-Genetic Distinctive Features Differing from /s/ when Manner is Given Precedence Over Voicing and Voicing over Place of Articulation, and Phonemes are Ranked, within the Category of Place of Articulation, in Terms of their Closeness to the Place of Modal /s/ Articulation

Phonemes Differing from /s/ by One Organo-Genetic Distinctive Feature

/θ/ /f/ /ʃ/ /tʃ/ /z/ /t/

Phonemes Differing from /s/ by Two Distinctive Features

/ð/ /v/ /ʒ/ /dʒ/ /p/ /k/ /d/ /n/ /l/

Phonemes Differing from /s/ by Three Distinctive Features

/b/ /w/ /j/ /g/ /r/ /m/ /ŋ/

TABLE VI

Hierarchy of Discrimination Tasks
Section I, Lessons 1 - 5: Discrimination of /s/ in Isolation from other Isolated Phonemes

Loudness

LESSON	Items 1 - 4	5 - 8	9 - 12
1	L	L	M
2	L	M	M
3	M	M	S
4	M	S	S
5	S	S	S

L - Loud
M - Moderate
S - Soft

Organo-Genetic Distinctive Features

LESSON	Items 1 - 4	5 - 8	9 - 12
1	3	3	2
2	3	2	2
3	2	2	1
4	2	1	1
5	1	1	1

3 - Contrast by 3 Distinctive Features
2 - Contrast by 2 Distinctive Features
1 - Contrast by 1 Distinctive Feature

Tasks

LESSON	Items 1 - 3	4 - 6	7 - 9	10 - 12
1	1	1	2	2
2	1	2	2	3
3	2	3	3	4
4	3	3	4	4
5	4	4	4	4

1 - Indicate whether Two Phonemes are the Same or Different
2 - Indicate whether /s/ is Present in a Group of Three or More Phonemes
3 - Indicate the Position of /s/ in a Group of Three Phonemes
4 - Count the Occurrences of /s/ in a Group of Four or More Phonemes

medium loudness level, contained a contrasting phoneme differing from /s/ by two distinctive features, and employed Task 3.

In Section II of the program, attention was focused on indication of whether two words were the same or different. Varying levels of discrimination difficulty were established through loudness, organo-genetic disctinctive features, and word pairs in initial, medial, and final position. Examination of the diagrams in Table VII will reveal the characteristics of each item in Section II. For example, Item 6 in Lesson 9 was presented at minimum loudness level, /s/ and the contrasting phoneme occurred in final position, and separation of the contrasting phoneme from /s/ was by one distinctive feature.

In Section III of the program attention was focused on indication of the position of /s/ in words. Varying levels of discrimination difficulty were established within a phonetic environment through loudness, duration, and organo-genetic distinctive features. Examination of the diagrams in Table VIII will reveal the characteristics of each item in Section III. For example, Item 11 of Lesson 13 was presented at minimum loudness and minimum duration, and a contrasting phoneme occuring in the same word was separated from /s/ by only one distinctive feature.

In Section IV of the program attention was focused on identification of presence of errors of production of /s/ in words. Varying levels of discrimination difficulty were established through loudness, duration, and types of errors of production of /s/. Examination of the diagrams in Table IX will reveal the characteristics of each item in Section IV. For example, Item 12 of Lesson 19 was presented at minimum loudness, with minimum duration, and contained a distortion close to the modal production of /s/.

C. Population Sample

Forty subjects from second, third, and fourth grades of the Arlington County (Virginia) Public Schools were selected for inclusion in the study on the basis of

1. Functional interdental misarticulation of the /s/ phoneme

TABLE VII

Hierarchy of Discrimination Tasks
Section II, Lessons 6 - 10: Discrimination of /s/ In Words

Loudness

		Items		
L		1 - 4	5 - 8	9 - 12
E	6	L	L	M
S	7	L	M	M
S	8	M	M	S
O	9	M	S	S
N	10	S	S	S

L - Loud
M - Moderate
S - Soft

Organo-Genetic Distinctive Features

		Items		
L		1 - 4	5 - 8	9 - 12
E	6	3	3	2
S	7	3	2	2
S	8	2	2	2
O	9	2	1	1
N	10	1	1	1

3 - Contrast by 3 Distinctive Features
2 - Contrast by 2 Distinctive Features
1 - Contrast by 1 Distinctive Feature

Position of /s/ in Words

L		1 - 4	5 - 8	9 - 12
E	6	I	I	F
S	7	I	F	F
S	8	I	F	M
O	9	F	F	M
N	10	F	M	M

I - Initial Position
F - Final Position
M - Medial Position

TABLE VIII

Hierarchy of Discrimination Tasks
Section III, Lessons 11 - 15: Identification of the Position of /s/ in Words

Loudness

		Items 1 - 4	5 - 8	9 - 12
L				
E	11	L	L	M
S	12	L	M	M
S	13	L	M	S
O	14	M	S	S
N	15	S	S	S

L - Loud
M - Moderate
S - Soft

Organo-Genetic Distinctive Features

		Items 1 - 4	5 - 8	9 - 12
L				
E	11	3	3	2
S	12	3	2	2
S	13	3	2	1
O	14	2	1	1
N	15	1	1	1

3 - Contrast by 3 Distinctive Features
2 - Contrast by 2 Distinctive Features
1 - Contrast by 1 Distinctive Feature

Duration

		Items 1 - 4	5 - 8	9 - 12
L				
E	11	L	L	M
S	12	L	M	M
S	13	L	M	S
O	14	M	S	S
N	15	S	S	S

L - Long
M - Medium
S - Short

TABLE IX

Hierarchy of Discrimination Tasks
Section IV, Lessons 16 - 20: Discrimination of Correctly Articulated from Misarticulated /s/ In Words

Loudness

		Items		
L		1 - 4	5 - 8	9 - 12
E	16	L	L	M
S	17	L	M	M
S	18	M	S	S
O	19	M	S	S
N	20	S	S	S

L - Loud
M - Moderate
S - Soft

Duration

		Items		
L		1 - 4	5 - 8	9 - 12
E	16	L	L	M
S	17	L	M	M
S	18	M	S	S
O	19	M	S	S
N	20	S	S	S

L - Long
M - Medium
S - Short

Types of Error

		Items		
L		1 - 4	5 - 8	9 - 12
E	16	O	O	S
S	17	O	S	S
S	18	O	S	D
O	19	S	S	D
N	20	D	D	D

O - Omission
S - Substitution
D - Distortion

2. General deficiency in auditory discrimination
3. Specific deficiency in auditory discrimination of the /s/ phoneme
4. Normal hearing acuity
5. Lack of previous speech therapy

Potential candidates were automatically excluded if they

1. Had previous history of unreliable attendance
2. Were considered likely to transfer during the school year
3. Were over-age in grade
4. Had known hearing losses
5. Had a known organic speech problem, including mal-occlusions resulting in /s/ distortions
6. Had non-standard dialectal patterns

A control group and an experimental group were established on the basis of a group equation of age, sex, and I.Q. as obtained from school records.

The experimental group was composed of twenty-one children from eight elementary schools of whom fifteen were boys and six were girls. The age range in months was 84 - 113 with a mean age of 92.86. I.Q. range for this group was 85 - 131 with a mean I.Q. of 106.05.

The control group was composed of nineteen children from six elementary schools of whom twelve were boys and seven were girls. The age range in months was 83 - 110 with a mean age of 94.42. I.Q. range for this group was 79 - 130 with a mean I.Q. of 106.57.

D. Tests

The following tests were administered before, immediately after, and one month after completion of the training period.

1. The Templin-Darley Diagnostic Test of Articulation. (28) This test consists of 176 items, has been standardized for validity and reliability, and was used to measure articulation performance. The twenty-five items pertaining to the /s/ phoneme provided a score for articulation of the /s/ phoneme; the remaining 151 items provided a score for articulation of phonemes other than /s/.

2. The Wepman Auditory Discrimination Test. (33) This test was used to examine general auditory discrimination ability. Form I was used in the pre and retention tests; Form II was used in the posttest.

3. Auditory Discrimination Test of the /s/ Phoneme. (See Appendix A.) This test and a test form for use with it were specially constructed for this investigation. The test, consisting of fifty items, was recorded on EFI magnetic tape by a male speaker and administered by means of the EFI Audio Notebook.

E. Administration of Automated Therapy

Prior to the administration of automated therapy all children who were selected for inclusion in the experimental group were given preliminary instruction in the use of the Audio Notebook and were given specific instruction in the manipulation of the channel switching controls. None of the children exhibited any marked difficulty in handling the equipment.

The experimental group ranged from two to three children in size. During the administration of the lessons, the children were seated with their backs turned to one another. The attendant adjusted headsets for each child, checked the proper functioning of the Notebook, and timed each child's performance individually. At the completion of a lesson, the child was directed, by recorded instruction on the tape, to raise his hand. The attendant then recorded the obtained time for the day's lesson.

F. Administration of Traditional Therapy

Traditional therapy was designed to parallel the content and tasks of automated therapy. Subject performance differed only in that verbal responses to discrimination tasks were elicited. No attempt was made to stimulate for correct production of /s/.

After six and on- half minutes of group instruction, the time required for errorless c- letion of an automated lesson, each member of the group w- ested. After three consecutive correct responses, his time w- ecorded for that lesson.

Group size for itional therapy varied from two to three subjects.

III. RESULTS

The purpose of the investigation was to compare the effectiveness of automated and traditional procedures for teaching auditory discrimination. Because the most frequently misarticulated phoneme is /s/, and because training in auditory discrimination is an integral part of classical articulation therapy, the investigation was limited to training in auditory discrimination of the /s/ phoneme. An automated program consisting of twenty lessons for self-instruction was developed for comparison with a traditional program of therapy.

Forty children from Grades two, three, and four with functional misarticulation of the /s/ phoneme and general deficiency in auditory discrimination of the /s/ phoneme were the subjects of this investigation. A control group and an experimental group, matched on the basis of age, sex, and I.Q., were established and instructed on auditory discrimination of the /s/ phoneme, and were evaluated on auditory discrimination of the /s/ phoneme, general auditory discrimination, articulation of the /s/ phoneme, and articulation of phonemes other than /s/. The evaluations are presented in connection with each of the hypotheses under investigation in this study.

A. Hypotheses

1. There is no significant difference between the experimental group and the control group on achievement in auditory discrimination of the /s/ phoneme.

Means and standard deviations of the pre, post, and retention measures for the experimental and control groups are reported in Table X.

TABLE X

Means and Standard Deviations of
Pre, Post, and Retention Measures

	Experimental Group		Control Group	
	Mean	SD	Mean	SD
Pre Test				
D/s/ +	9.19	6.48	10.37	5.04
D	7.38	2.89	7.53	2.30
A/s/	5.52	4.81	8.26	5.71
A	130.95	14.55	138.58	5.48
Post Test				
D/s/	3.43	3.09	4.32	3.87
D	2.95	1.21	2.74	1.33
A/s/	17.33	7.06	20.32	5.43
A	140.76	10.56	145.58	2.76
Retention				
D/s/	4.48	3.70	5.53	4.71
D	3.76	1.92	3.68	1.75
A/s/	15.95	7.47	19.84	6.12
A	140.29	10.44	144.68	2.88

+ Key: D/s/ - auditory discrimination of the /s/ phoneme; D - general auditory discrimination; A/s/ - articulation of the /s/ phoneme; A - articulation of phonemes other than /s/. (Discrimination data was computed in error scores; articulation data in correct responses.)

A t test was used to compare the pre, post, and retention mean achievement on the Auditory Discrimination Test of the /s/ Phoneme of the experimental group and the control group. The results are presented in Table XI.

TABLE XI

Mean Comparisons of Achievement in Auditory Discrimination of the /s/ Phoneme at Pre, Post, and Retention Testing Levels Between the Experimental and Control Groups

	Mean Diff	SEDiff	t
Pre	1.18	1.90	0.62
Post	0.89	1.13	- 0.79
Retention	1.05	1.37	0.77

t_{01} (df = 38) = 2.71

Null hypothesis accepted at .01 level

Table XI indicates that no significant differences in achievement in auditory discrimination of the /s/ phoneme were found between the experimental and control group means at pretesting, posttesting or retention testing.

2. There is no significant difference between the experimental group and the control group on rate of achievement in auditory discrimination of the /s/ phoneme.

The Kolmogorov - Smirnov test was used to determine differences in central tendency, variation, and skewness between the two distributions. Table XII summarizes the results of this analysis.

TABLE XII

Kolmogorov-Smirnov Test of Time Differences Between the Experimental and Control Groups

$$D = \max S_{mt} - S_{na} = \frac{277}{399}$$

$$X^2 = 4D^2 \frac{n_1 n_2}{n_1 + n_2} = \frac{4 (277)^2}{(399)} \quad \frac{(21) \quad (19)}{21 + 19} = 18.98$$

$$df = 2$$

X^2 significant beyond .01 level; rejection of null hypothesis.

A one criterion analysis of variance was used to determine the significance of mean time differences between the experimental group and the control group. The analysis of variance summary table is presented in Table XIII.

TABLE XIII

Mean Differences in Time Between the Experimental and Control Groups

	df	SS	MS(V)	F
SS Among	1	2,462	2,462	13.17**
SS Within	38	7,116	187	
Total	39	9,578		

$$F = \frac{2,462}{187} = 13.17$$

**Null hypothesis rejected at .01 level

The control group completed the twenty lessons in significantly less time than did the experimental group. The minimum mean time for completion of a lesson in the experimental group was 7.11 minutes and the maximum mean time was 9.28 minutes. The minimum mean time in the control group was 6.52 minutes and the maximum mean time was 8.08 minutes. The average time for the two groups was computed at 8.20 minutes for the experimental group and 7.41 minutes for the control group. In summary, the experimental group took longer to complete the program and showed a greater spread of time scores.

3. There are no significant differences between the experimental group and the control group on achievement in general auditory discrimination, articulation of the /s/ phoneme, or articulation of phonemes other than /s/.

A t test was used to compare the pre, post, and retention mean achievement of the experimental group and control group on general auditory discrimination, as measured by the Wepman

Auditory Discrimination Test, and on articulation of both the /s/ phoneme and phonemes other than /s/, as measured by the Templin-Darley Test of Articulation. The results are presented in Tables XIV, XV, and XVI.

TABLE XIV

Mean Comparisons of Achievement in General Auditory Discrimination at Pre, Post, and Retention Testing Levels Between the Experimental And Control Groups

	Mean Diff	SEDiff	t
Pre	.15	.82	.18
Post	.21	.40	.53
Retention	.08	.53	.15

t_{01} (df = 38) = 2.71

Null hypothesis accepted at .01 level

TABLE XV

Mean Comparisons of Achievement in Articulation of the /s/ Phoneme at Pre, Post, and Retention Testing Levels Between the Experimental and Control Groups

	Mean Diff	SEDiff	t
Pre	2.74	1.68	1.63
Post	2.99	1.98	1.51
Retention	3.89	2.15	1.81

t_{01} (df = 38) = 2.71

Null hypothesis accepted at .01 level

TABLE XVI

Mean Comparisons of Achievement in Articulation of Phonemes Other Than /s/ at Pre, Post, and Retention Testing Levels Between the Experimental and Control Groups

	Mean Diff	SEDiff	t
Pre	7.63	3.42	2.23
Post	4.82	2.39	2.02
Retention	4.39	2.37	1.85

t_{01} (df = 38) = 2.71

Null hypothesis accepted at .01 level

Inspection of Tables XIV, XV, and XVI reveals that there were no statistically significant differences between the means of the two groups on general auditory discrimination, articulation of the /s/ phoneme, and articulation of phonemes other than /s/, at pre, post, or retention testing levels.

4. There are no siginificant differences between pre and post program performance on auditory discrimination of the /s/ phoneme, general auditory discrimination, articulation of the /s/ phoneme, and articulation of phonemes other than /s/ for the experimental group or the control group.

A correlated t test was used to test the significance of the mean gains from pre to post program testing for the experimental group and for the control group. The results are presented in Tables XVII and XVIII.

TABLE XVII

Mean Comparisons of Pre and Post Program Measures on Auditory Discrimination of the /s/ Phoneme, General Auditory Discrimination, Articulation of the /s/ Phoneme, and Articulation of Phonemes Other Than /s/ for the Experimental Group

	Mean Diff	SEDiff	t
D/s/	5.76	1.15	5.01**
D	4.43	0.63	7.03**
A/s/	11.81	1.32	8.95**
A	9.81	2.02	4.86**

t_{01} (df = 20) = 2.84

**Null hypothesis rejected at .01 level

TABLE XVIII

Mean Comparisons of Pre and Post Program Measures on Auditory Discrimination of the /s/ Phoneme, General Auditory Discrimination, Articulation of the /s/ Phoneme, and Articulation of Phonemes Other Than /s/ for the Control Group

	Mean Diff	SEDiff	t
D/s/	6.05	1.06	5.70**
D	4.79	0.53	9.04**
A/s/	12.06	1.14	10.58**
A	7.00	1.35	5.19**

t_{01} (df = 18) = 2.88

**Null hypothesis rejected at .01 level

Tables XVII and XVIII indicate that both the experimental group and the control group made significant gains from pre to posttesting in each of the four abilities investigated in this study.

5. There are no significant differences in retention of achievement on auditory discrimination of the /s/ phoneme, general auditory discrimination, articulation of the /s/ phoneme, and articulation of phonemes other than /s/ for the experimental group or the control group.

Retention of achievement was evaluated from post program to retention testing and from pre program to retention testing. From post program to retention testing, each group showed an increase in mean error responses on discrimination of the /s/ phoneme and general auditory discrimination; each also showed a decrease in mean correct responses on articulation of the /s/ phoneme and articulation of phonemes other than /s/. However, from pre program to retention testing, each group demonstrated a decrease in mean error responses and an increase in mean correct responses. (See Table X.)

A correlated t test was used to test the significance of the mean differences from post program to retention testing, and from pre program to retention testing, for the experimental group and for the control group. The results are presented in Tables XIX and XXI for the experimental group and in Tables XX and XXII for the control group.

TABLE XIX

Mean Comparisons of Post Program and Retention Measures on Auditory Discrimination of the /s/ Phoneme, General Auditory Discrimination, Articulation of the /s/ Phoneme, and Articulation of Phonemes Other Than /s/ for the Experimental Group

	Mean Diff	SEDiff	t
D/s/	1.05	0.52	2.03
D	0.81	0.25	3.18**
A/s/	1.38	1.34	1.02
A	0.47	0.67	0.64

t_{01} (df = 20) = 2.84

**Null hypothesis rejected at .01 level

TABLE XX

Mean Comparisons of Post Program and Retention Measures on Auditory Discrimination of the /s/ Phoneme, General Auditory Discrimination, Articulation of the /s/ Phoneme, and Articulation of Phonemes Other Than /s/ for the Control Group

	Mean Diff	SEDiff	t
D/s/	1.21	0.35	3.42**
D	0.94	0.25	3.72**
A/s/	0.48	1.80	0.27
A	0.90	0.36	2.50

t_{01} (df = 18) = 2.88

**Null hypothesis rejected at .01 level

TABLE XXI

Mean Comparisons of Pre Program and Retention Measures on Auditory Discrimination of the /s/ Phoneme, General Auditory Discrimination, Articulation of the /s/ Phoneme, and Articulation of Phonemes Other Than /s/ for the Experimental Group

	Mean Diff	SEDiff	t
D/s/	4.71	1.03	4.57**
D	3.62	0.60	6.04**
A/s/	10.43	1.46	7.14**
A	9.34	1.89	4.94**

t_{01} (df = 20) = 2.84

**Null hypothesis rejected at .01 level

TABLE XX

Mean Comparisons of Post Program and Retention Measures on Auditory Discrimination of the /s/ Phoneme, General Auditory Discrimination, Articulation of the /s/ Phoneme, and Articulation of Phonemes Other Than /s/ for the Control Group

	Mean Diff	SEDiff	t
D/s/	1.21	0.35	3.42**
D	0.94	0.25	3.72**
A/s/	0.48	1.80	0.27
A	0.90	0.36	2.50

t_{01} (df = 18) = 2.88

**Null hypothesis rejected at .01 level

TABLE XXI

Mean Comparisons of Pre Program and Retention Measures on Auditory Discrimination of the /s/ Phoneme, General Auditory Discrimination, Articulation of the /s/ Phoneme, and Articulation of Phonemes Other Than /s/ for the Experimental Group

	Mean Diff	SEDiff	t
D/s/	4.71	1.03	4.57**
D	3.62	0.60	6.04**
A/s/	10.43	1.46	7.14**
A	9.34	1.89	4.94**

t_{01} (df = 20) = 2.84

**Null hypothesis rejected at .01 level

TABLE XXII

Mean Comparisons of Pre Program and Retention Measures on Auditory Discrimination of the /s/ Phoneme, General Auditory Discrimination, Articulation of the /s/ Phoneme, and Articulation of Phonemes Other Than /s/ for the Control Group

	Mean Diff	SEDiff	t
D/s/	4.84	1.07	4.52**
D	3.85	0.39	9.87**
A/s/	11.58	1.23	9.41**
A	6.10	1.24	4.92**

t_{01} (df = 18) = 2.88

**Null hypothesis rejected at .01 level

Tables XIX and XX indicate that, from post program testing to retention testing, the increase in mean error responses on general auditory discrimination was statistically significant for both the experimental group and the control group. In addition, the increase in mean error responses on auditory discrimination of the /s/ phoneme was significant for the control group, but not for the experimental group. However, as can be seen in Tables XXI and XXII, from pre program testing to retention testing, the decrease in mean error responses on general auditory discrimination and on auditory discrimination of the /s/ phoneme was statistically signifcant for both groups.

Tables XIX and XX indicate that, from post program to retention testing, the decrease in mean correct responses on articulation of the /s/ phoneme and on phonemes other than /s/ was not statistically significant for either group. However, Tables XXI and XXII indicate that, from pre program to retention testing, the increase in mean correct responses on articulation of the /s/ phoneme and on phonemes other than /s/ was statistically significant for both groups.

B. Summary

Although the experimental group took longer to complete the program in auditory discrimination of the /s/ phoneme, both the experimental and control groups progressed in similar manner and made similar gains from pre to post program testing. Both groups improved not only in auditory discrimination of the /s/ phoneme, the behavior for which the program was designed, but also in general auditory discrimination, articulation of the /s/ phoneme, and articulation of phonemes other than /s/. Furthermore, both groups improved on all four behaviors from pre program to retention testing.

IV. DISCUSSION

For the purpose of comparing the effectiveness of automated and traditional procedures for teaching school children auditory discrimination of the /s/ phoneme, two matched groups were instructed in auditory discrimination of the /s/ phoneme and evaluated on achievement in auditory discrimination of the /s/ phoneme, general auditory discrimination, articulation of the /s/ phoneme, articulation of phonemes other than /s/, and retention of achievement. The results will be discussed in terms of achievement in the four skills and retention of achievement in the four skills.

A. Auditory Discrimination of the /s/ Phoneme

The programs for self-instruction and for traditional instruction were parallel in content and were limited to auditory discrimination of the /s/ phoneme. The mean changes from pre to post program testing reflect improvement of nineteen of the twenty-one children in the experimental group and sixteen of the nineteen children in the control group. Comparison of the two groups indicates that achievement was essentially the same for both.

The group participating in automated therapy took a significantly longer time to complete the lessons than did the group participating in traditional therapy. In addition, the experimental group demonstrated greater variability in time. In the automated program, as in all programmed instruction, each child was able to progress at his own pace. That the children in the experimental group moved at a slower pace than did the children in the control group is interesting.

B. General Auditory Discrimination

To determine the effect of training in auditory discrimination of the /s/ phoneme on ability in general auditory

discrimination, Form I of the Wepman Auditory Discrimination Test was administered prior to the program and Form II at the end of the program. The significant mean gains of the experimental and control groups indicate that achievement occurred. Nineteen of the children in the experimental group and all of the children in the control group improved in general auditory discrimination performance. Comparison of the two groups shows that achievement was essentially the same for both.

One of the requirements for participation in this investigation was the existence of generalized difficulty in auditory discrimination, based on the norms of the Wepman Test. Therefore, a generalized auditory deficit was characteristic of each child in the experimental group and the control group at pre program testing. At post program testing of general auditory discrimination, thirty-six of the forty children were within normal limits; eighteen in the experimental group and eighteen in the control group.

It is not surprising that training in auditory discrimination of the /s/ phoneme resulted in improved general auditory discrimination. The most obvious explanation of this result is that as the children learned to discriminate the /s/ phoneme, they were exposed to a variety of contrasting phonemes and also learned the basic skills of auditory discrimination.

C. Articulation of /s/ Phoneme

This study confirms the finding of Holland and Matthews (12) and of Holland (13) that skill in articulation of the /s/ phoneme is improved as a function of /s/ auditory discrimination training. The experimental group and the control group showed like performance on articulation of the /s/ phoneme from pre to post program testing, and the significant mean gains of each group for this period represent an improvement in /s/ articulation for every child in both groups. Furthermore, at post program testing, one-fourth of all the children in both groups articulated /s/ correctly in each of the twenty-five phonetic environments inventoried in this study. Five of these children were in the experimental group and five were in the control group.

In one of the earliest statements on ear training, Travis (30) emphasized that ear training on a phoneme is in fact training in production of that phoneme. In comparing learning a phoneme to learning a song, he said, "We do not learn it by drilling but rather by hearing it." He suggested that "...instead of the individual learning by acting he acts to see if he has learned." The results of this study would seem to support the truth of this early observation by Travis.

D. Articulation of Phonemes Other Than /s/

All children selected for participation in this study misarticulated one or more phonemes in addition to the /s/ phoneme. Although instruction was limited to auditory discrimination of the /s/ phoneme, the mean gains from pre to post program testing in articulation of phonemes other than /s/ were significant for both groups. No child corrected all of his errors, but improvement in general articulation was demonstrated by thirty-four of the forty children. Of the thirty-four, seventeen were in the experimental group and seventeen in the control group.

Even though the increase in correct response was statistically significant, the lack of sensitivity of the measuring instrument used in this study precludes making fine interpretations of the data. In scoring, one point was lost for each misarticulation regardless of type or severity. That an omission represents a more severe from of misarticulation than does a distortion and that there are degrees of severity of misarticulation within types is generally recognized, but the measuring instrument did not provide for differential weighting of type and degree of severity.

E. Retention

Participants in this investigation not only improved significantly in auditory discrimination of the /s/ phoneme, general auditory discrimination, articulation of the /s/

phoneme, and articulation of phonemes other than /s/, but also retained the improvement. Retention of improvement was measured from post program to retention testing and from pre program to retention testing.

Although the mean differences between post and retention testing of auditory discrimination of the /s/ phoneme were slight for both groups ($MD_E = 1.05$, $MD_C = 1.21$), the results of the t test indicated a significant loss for the control group. This finding reflects the greater sampling variability in the experimental group rather than a meaningful difference in performance. The conclusion is strengthened by the finding that both groups made significant mean gains from pre to retention testing ($MD_E = 4.71$, $MD_C = 4.84$).

Similarly, in the mean comparison of post program and retention measures of general auditory discrimination, although the loss was statistically significant for each group, the actual values were slight ($MD_E = 0.81$, $MD_C = 0.94$) in contrast to the significant mean gains from pre program to retention testing ($MD_E = 3.62$, $MD_C = 3.85$).

From post program to retention testing, the measures of articulation of the /s/ phoneme and of articulation of phonemes other than /s/ showed neither a statistically significant nor a meaningful change. Significant gains in articulation were demonstrated by both groups from pre program to retention testing.

Thus, both the experimental group and the control group achieved on all four abilities and retained their achievement.

V. CONCLUSIONS

The results of this investigation indicate that automated and traditional procedures are equally effective in teaching children to discriminate the /s/ phoneme. In addition, even though instruction by each method was limited to auditory discrimination of the /s/ phoneme, both the experimental and control groups made significant progress in three skills for which no instruction was given: general auditory discrimination, articulation of the /s/ phoneme, and general articulation. Furthermore, both groups retained achievement in all four skills.

This investigation was conducted in a public school system, as a part of the program in speech pathology. Automated instruction was well received and no problems were encountered. It would appear that the addition of automated procedures in speech pathology to public school programs is both practicable and desirable.

The insistent demand for competent services in speech pathology and the critical shortage of qualified speech pathologists are well recognized and well documented. Although the Federal Government and University training programs are making unprecedented efforts to increase the supply of qualified speech pathologists, the gap between demand and supply continues. The potential of automated instruction for meeting the current crisis is considerable and the need for further investigation is urgent.

Numerous lines of inquiry into programming for speech pathology might prove rewarding. Additional comparative studies of automated therapy and traditional therapy might be conducted. Further investigation might include the development and testing of additional self-instructional programs on phonemes other than /s/, and studies of the effect of automated procedures in auditory discrimination of specific phonemes, or constellations of phonemes, on articulation of those phonemes, on general articulation and on general auditory discrimination. Programs in auditory discrimination might be developed and tested for beginning readers, for the dialectically handicapped, for speakers of English as a second language, and for the hearing impaired.

VI. SUMMARY

An evaluation was made of the relative effectiveness of automated and traditional procedures in teaching school children auditory discrimination of the /s/ phoneme. For the investigation, a self-instructional program was developed and used with equipment which provided for continuous adjustment on the basis of response. Two matched groups were instructed in auditory discrimination of the /s/ phoneme, and were evaluated on achievement in auditory discrimination of the /s/ phoneme, general auditory discrimination, articulation of the /s/ phoneme, general articulation, and retention of achievement. Both the control and experimental groups showed significant learning in, and retention of, discrimination of the /s/ phoneme, general discrimination, articulation of the /s/ phoneme, and general articulation. The members of the experimental group, unlike the members of the control group, determined their rate and, interestingly, the experimental group took longer to complete the program. Mean comparisons between and within the control and experimental groups indicated the same relative performance for each group; and no significant difference in the effectiveness of the two methods was demonstrated.

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APPENDIX A

Auditory Discrimination Test of the /s/ Phoneme

You have a paper with your name on it. Don't mark on the paper until I tell you to do so.

You are going to listen for a special sound: /s/ /s/ /s/. Do you hear it? Listen to it again: /s/ /s/ /s/. This is our special sound.

Now listen to another sound: /m/ /m/ /m/. It's not like our special sound, is it? No, it's a completely different sound.

Now listen to another different sound: /f/ /f/ /f/. This sound is closer to our special sound, but it's not quite the same, is it? No, it's a different sound, also.

Now, I'm going to say three sounds in a row. Listen closely and see if you hear our special sound among them: /ʒ/ /l/ /s/. Did you hear our special sound? You should have. Listen again: /ʒ/ /l/ /s/. Yes, it was the last sound of the three, wasn't it?

Now look at your paper and see the big "A" printed on it. Under the "A" are numbers. Beside each number is a happy face and an unhappy face. The happy face is listening to the /s/ sound. The unhappy face is listening to other sounds.

Look at number 1 and see if you hear /s/ among the three sounds I shall make.

Number 1 is /m/ /n/ /s/. See the mark on the happy face beside number 1. Our special sound, /s/, was one of the three sounds so the happy face was marked.

Now look at number 2 and see if you hear /s/ among the three sounds I shall make.

Number 2 is /ʃ/ /θ/ /f/. See the mark on the unhappy face beside number 2. Our special sound was not one of

the three, was it? No. So the unhappy face was marked. Now, you make the marks.

A.

Number	3	tʃ	f	z
Number	4	f	s	ʒ
Number	5	z	ʃ	dʒ
Number	6	s	tʃ	z
Number	7	ʒ	f	ʃ
Number	8	ʃ	f	s
Number	9	v	f	θ
Number	10	z	ʒ	ʃ
Number	11	dʒ	s	ʒ
Number	12	s	v	ʃ

Now put your crayon down and look at part B on your paper.

Some words have a /s/ sound in them.

We are not thinking about the spelling or letters in the words but about the /s/ sound that you might hear in them.

When I say, cent, do you hear the /s/ sound? Yes. See the picture of a cent beside number 1. It is marked because it has a /s/ in it. When I say, tent, do you hear /s/? No. The tent picture is not marked. I will say the words beside the other numbers. Mark the pictures that have the /s/ in them.

B.

Number	2	ice	eyes
Number	3	sew	toe
Number	4	one	sun
Number	5	see	key
Number	6	write	rice
Number	7	mouse	mouth
Number	8	kick	kiss
Number	9	soap	rope
Number	10	sheet	seat
Number	11	castle	camel

In the next part, C, we have sentences. Some of the words in the sentences have /s/ in them. The first one is: "See the clown." "See" has a /s/ in it. "See" is marked. "The" does not have a /s/ in it. "The" is not marked. "Clown" does not have a /s/ in it. "Clown" is not marked. You mark the /s/ words in these sentences.

C.

Number	2	Ride a horse.
Number	3	I like to swim.
Number	4	Her bunny hops.
Number	5	The chimney smokes.
Number	6	She sleeps at night.
Number	7	He cut the grass.
Number	8	Your socks are on the chair.
Number	9	She sat on a chair.
Number	10	We have a box.
Number	11	She made a star.

Now I'll say some sentences again in part D. Sometimes I will make mistakes.

D.

Number	1	I'm trying to say: "See the sun." I'm saying: "Thee the thun." Is that right? No, so the unhappy face is marked.
Number	2	"Sing a song." Is that right? Yes, so the happy face is marked. You mark the other faces.
Number	3	We are in thkool.
Number	4	We ride on a bus.
Number	5	Go outside to play.
Number	6	He hurt himself.
Number	7	We live in a houth.
Number	8	I am in class.
Number	9	Yeth, I am.
Number	10	You ride a bithikle.
Number	11	I have a new thweater.
Number	12	We like to race.

Here's something different. See part E. After each number are three boxes. Look at number 1. There is a first box, a middle box and a last box. When we say words that have the /s/ in them, we hear the /s/ in different places in the words.

E.

Number 1 Sally. /s/ is the first sound we hear. The first box after number 1 is marked.

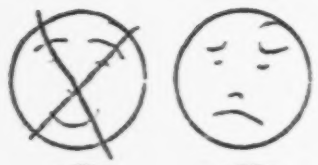
Number 2 House. /s/ is the last sound. The last box is marked beside number 2.

Number 3 Pencil. /s/ is in the middle. The middle box is marked beside number 3.

You mark the rest of the boxes.

Number 4 sky
Number 5 face
Number 6 beside
Number 7 chance
Number 8 sand
Number 9 south
Number 10 nice
Number 11 once
Number 12 thirsty
Number 13 scratch

A

1. 
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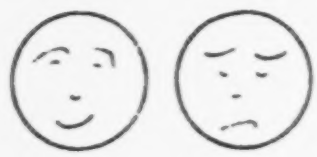
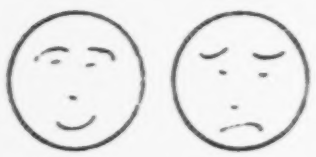
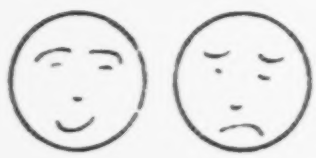
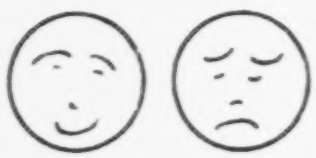
3. 
4. 
5. 
6. 
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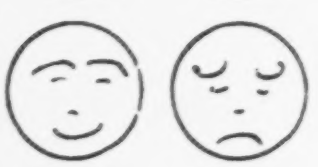
10. 
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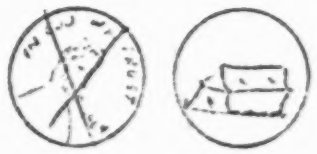
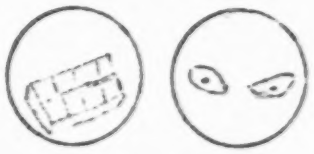
1. 

2. 

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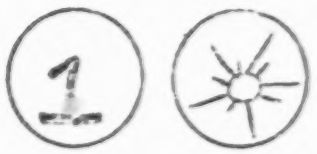
4. 

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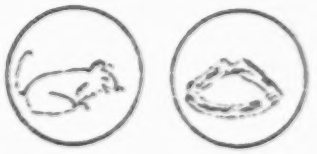
7. 

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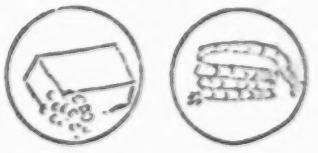
9. 

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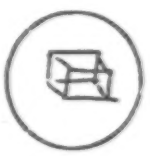
10. have a 

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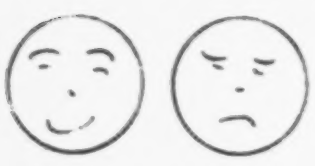
6 

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